UTAH DIVISION OF WILDLIFE RESOURCES

NEW ZEALAND MUDSNAIL (*Potamopyrgus antipodarum*) MANAGEMENT PLAN

FOR LOA HATCHERY

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Loa State Fish Hatchery Status

The aquatic invasive species New Zealand Mudsnail (NZMS) was found in the main spring complex and throughout the outside cement rearing system at the Loa Hatchery in late November 2007. Springs providing water for the hatchery building and truck loading system have remained free of NZMS. The Loa Hatchery is owned and operated by the Utah Division of Wildlife Resources (Division).

Purpose

To develop a NZMS management plan that addresses both the short term and long-term direction for the Loa Hatchery

Short Term strategy for decontamination of the existing trout stocks on station.

To determine extent of the NZMS infestation in fish groups at the Loa Hatchery, the staff sampled 100 fish from rearing units in the hatchery building and 100 fish from the large outside raceways. The stomachs and digestive tracts of each fish were physically examined for the presence of snails. Snails were to be identified as either an unknown native species or NZMS, but no snails were found in any of the fish sampled. These fish stocks will continue to be sampled at least quarterly until a determination is made to either stock them in waters already containing NZMS or destroy the fish.

1. Protocols for stocking infested fish from the Loa Hatchery into NZMS infested waters:
    a. A minimum of quarterly, sample 100 fish from the hatchery building and 100 fish from the outside raceway system to determine the presence of NZMS. Each fish's stomach and digestive tract will be examined for the presence of snails by lethal, ocular and microscopic inspection.
    b. Fish scheduled for stocking will be placed in the raceway system that has been cleaned as follows:
        i. Use a high-pressure hot water washer, spraying 140 degree F. water at a point 12 inches from the nozzle, to remove all sludge, vegetation, and snails, paying particular attention to seams, corners, screen channels and backing boards.
        ii. After pressure washing, spray the inside of the raceway with a quaternary ammonium compound that contains the active ingredient - Alkyl dimethyl benzyl ammonium chloride (ADBAC), at a concentration of 5.0%. Then, allow the raceway to sundry for 48 hours, if possible.
        iii. The cleaned and disinfected raceway will be filled with filtered water from the hatchery building water supply.

1. Sack or screen filters, capable of filtering particles larger than 150 microns, will be used to filter all water coming into the raceways.
2. Water level and flow for the raceways will be set at a depth to maintain a minimum velocity of 0.25 feet per second. This flow will move any previously ingested NZMS discharged by the fish through the system.

iv. All fish scheduled for stocking will be moved into the cleaned and disinfected raceway, and held 96 hours prior to stocking.

v. Immediately prior to stocking, the presence of NZMS will be determined by examining the complete digestive tract of 100 fish as described above.

1. If no snails are found in the sampled fish, the lot of fish in the raceway will be considered free of NZMS and stocked into waters infested with NZMS. Appendix A, lists waters currently infested with NZMS.
    a. All water used to transport fish to stocking location will be filtered with a 100 micron bag filter.
2. If 1 or more snails are found in a sample, the group will be held for 7 more days in a disinfected raceway. Fish will be feed normally for the first 5 days and held off food for the last 2 days. At the end of the 7-day holding period, another sample of 100 fish will be collected and checked for the presence of snails.
3. If no snails are founds, the group will be considered free of snails and stocked into NZMS infested waters.
    a. If 1 or more snails are found then fish will not be stocked. Fish well be removed from the disinfected raceway and placed into another raceway. The filters and water supply for the disinfected raceway will be evaluated for NZMS presence. If filter or water supply problems are found, they will be fixed and the raceway will be re-disinfected following the protocol outlined in subsections 1.b.i and 1.b.ii. Fish will then be moved back into this raceway 96 hours prior to stocking and subsection 1.b.iii.v.1 through 1.b.iii.v.3 will be repeated.

c. The Loa Hatchery staff will modify their current HACCP plan to include dealing with the presence of NZMS and ensure that all operations at the hatchery follow the plan.

d. The Fisheries Experiment Station (Logan) will continue to conduct research on other NZMS control methods.

2. The Division of Wildlife Resources (Division) Aquatics Section will maintain a current list of all waters in the state infested with New Zealand Mudsnail. The Aquatic Invasive Species Coordinator (AIS Coordinator) will be responsible for keeping the list up-to-date.

The Division will make the final determination if it is in the best interest of the State to stockfish that might be infested with NZMS. If the decision is to not stock the fish currently held at the Loa Hatchery, then the fish will be killed, buried in quick lime, the hatchery disinfected, cleaned and closed until funds can be procured to collect the springs and rebuild the water delivery system and raceways.

Long term Strategy to contain the springs at the Loa Hatchery and remove NZMS from the hatchery

1. Potential methods to remove NZMS from the hatchery's water supply can be lumped into four categories – (a) chemical treatment, (b) filtration, (c) collection and burial (Cut-off trench) and (d) drilling a well.

    a. Chemical treatment of the water delivery/drain systems and rearing units is the only sure way to remove snails from the system. Initial investigation of the main spring indicates that there are several native snail species present. As a result, chemical treatment of the water supply would be unacceptable, without removing or relocating these native species first. A thorough inventory of all plant, animal and mollusk species in the complex will have to be conducted prior to permitting work in the area. There are several categories of chemicals that work well to kill NZMS with a short contact time. The categories are:
        i. Quaternary ammonium compounds (alkyl dim-ethyl benzyl ammonium chloride (ADBAC) – active ingredient listed as 0.3% or greater); NZMS are killed when exposed to the following concentration for 10 minutes: The following are examples of some of the ADBAC compounds that can be used: 4.6% QUAT 128 solution (1 Liquid oz. QUAT 128 per gallon water = 6.4 oz/gal.; 1 gallon QUAT 128 per 100 gallons = 5 %) OR STEPANQUAT 50 NF (HYAMINE) solution (1.3 ml STEPANQUAT 50 NF (HYAMINE 50% Active Ingredients) per gallon water = 187 ppm or 5.0% solution).
        ii. Placing 4 inch wide copper strips or painting bans of cuprous oxide-based marine antifouling paint or cuprous thiocyanate-based marine antifouling paint on the waterside of a hatchery's outfall structure may help to keep snails from moving upstream.
        iii. During daily operations it is important to not cross-contaminate areas of the hatchery with NZMS transported on footwear or equipment. Shoes, boots, waders, and other equipment having contact with hatchery water should have all attached debris removed. Scrub with a stiff-bristled brush, then visually inspect, since snails frequently collect between the laces and tongue of footwear and on/in felt soles. Follow the inspection with tap water rinse, where possible. Then, either (1) Spray gear with Formula 409 (the correct Formula 409 product lists dim-ethyl benzyl ammonium chloride as 0.3%) to kill snails. Contact time should be at least 30 minutes. Or, (2) Spray gear with copper sulfate solution having a concentration of 252 mg/l of copper to kill snails (1 oz of Copper Sulfate powder/10 gallons of water). Requires a contact time of more than 5 minutes.

            Note: In either case, allow gear to dry as much as possible prior to reuse.

        iv. If decontaminating large pieces of equipment, use a quaternary ammonium compound with a 50% active ingredient of ADBAC, which can be purchased in 5, 15 and 55-gallon drums from bulk chemical distributors.
        v. Other processes (require research to determine effectiveness)
            1. Electrical fields
            2. Ionization and magnetic arrays

    b. Filtration of the water delivery system.
        i. Mature NZMS range in size from 3 to 6 mm, while immature snails will range from 0.16 to 0.6 mm. Filtration media needs to be capable of filtering particles

smaller than 160 microns, preferably in the 100 micron range, and be able to handle large amounts of the vegetation and debris that are normally washed into the system. Method for filtering NZMS from the hatchery's water supply include:

1. Bag filters are available in the opening size required to remove NZMS and are economical. In order to handle the flows required at the Loa Hatchery, a large array of filters would have to be set up with a method of pre-filtration to remove moss, weeds, twigs etc. Once a filter is plugged it has to be physically removed and replaced with a new filter. This process would make the installation labor intensive.
2. Drum and Disc filters would handle the incoming flows but experience has shown that these filters, though capable of filtering out small particles allow some particles to bypass the filtration process due to seal problems between the drum and frame.
3. Membrane filtration – There are a number of membrane filter on the market that are capable of filtering NZMS from the water supply, they all require pumps to move water through the filters and operate the back wash system. We would like to keep the Loa Hatchery as pump free as possible.

c. Collection and burial of the water delivery system.
    i. The "Feasibility Study for Improvements and Construction of Fish Hatcheries" completed by FishPro in October 1996. In the "Loa Hatchery Enhancement Plan" it was recommended that the hatchery's water system be collected in a cut-off trench drain.
        1. The drain would be installed down slope from the impervious layer to intercept water flows emerging from the hillside above the hatchery. The bottom of the trench would be set into the impervious layer to ensure no water leaks under the trench.
        2. An impervious fabric would be placed on the bottom and down slope side of the trench to dam up water flowing off of the impervious layer. A perforated pipe and a filter material (sand or gravel) is then placed in the trench to collect water dammed by the trench and a compacted soil layer of clay would cap the trench to keep surface water from infiltrating the collection system.
d. Well drilling alternative
    i. Ben Everitt with the Utah Division of Water Resources proposed collecting water from the spring source at Loa Hatchery using wells, in 2002. The Loa springs emerge directly from bedrock to the west of the hatchery. The aquifer is capped with an impervious volcanic tuff that prevents surface contamination. Mr. Everitt proposed two options depending on the actual configuration of the aquifer:
        1. If the spring orifices are compact sources emerging from rock, then spring boxes could be constructed on rock foundations as needed to collect water
        2. If the aquifer is extensive or diffuse, with spring sources controlled by unconsolidated material or willow roots, a drain trench with perforated pipe in a gravel envelope could be used similar to collection system proposed by FishPro.

    Extensive investigation of the spring area would be required prior to accepting either option.

Of the proposed solutions to remove and keep snails out of the spring complex at Loa, collection and burial of the water delivery system alternatives appears to be the most secure alternative. Collecting process water before it is exposed to the surface will prevent exposure to NZMS and other aquatic invasive species, fish diseases and other surface contaminants into the future. Without a secure water source that is free of aquatic invasive species and pathogens the hatchery will continue to be susceptible to any number of problems. Any work performed on the piping and rearing units would be temporary at best. This proposal will be subject to permitting by the Army Corps of Engineers, a feasibility study and engineers working closely with a wetland specialist and geologist to ensure sufficient water is collected to operate the hatchery at its pre-NZMS infestation level.

2. Methods to permanently remove NZMS from the hatchery's water distribution system and rearing units.
    a. NZMS infestation in the spring complex has to be addressed prior to considering any program to remove snails from the piping and rearing units.
    b. Depopulate the hatchery of fish stocks and divert all water from the facility.
    c. Place 4 inch wide copper sheeting to the inside surfaces of all hatchery outlet structures.
    d. Piping should have the copper attached to the inside surface of the pipe, with a minimum of 1 inch of copper extending beyond the end of the pipe
        i. Raceways or distribution boxes discharging directly into a settling basin or stream should have the copper striping attached continuously from the top of side wall across the floor and to the top of the adjacent side wall. The strip should be attached within two inches of the end of the structure.
        ii. Starting at the piping system closest to the spring, use a power washer capable of producing 140 degree F. water 12 inches from the sprayer nozzle. Clean all sludge, scale, vegetation and dirt from rearing units and the interior surfaces of accessible water distribution pipes. Pay particular attention to cracks, seams, joints, screen slot and any areas where snails might hide, and work to the bottom of the hatchery.
    e. After the facility has been cleaned, spray all surfaces, including all interior surfaces of all water distribution pipes, with a 5.0% solution of quaternary ammonium.
    f. In areas where the water distribution pipes cannot be cleaned or power washed, completely fill the system with a 5.0% solution of quaternary ammonium and allow to stand a minimum of 4 hours.
    g. Allow the facility to air dry at least two weeks.

Recommendations for a long term solution to the NZMS problem at the Loa Hatchery

It is the Division's intent to pursue the water collection and containment alternative. The long-term development at the Loa Hatchery addresses the presence of NZMS in the adjacent watershed and provides a water supply and facility that will prevent reintroduction. The following issues will have to be addressed in order to keep NZMS from being reintroduced and protect native snails in the spring complex.

1. Determine the feasibility of collecting the entire spring source or sufficient water to operate the hatchery at its pre NZMS levels or above.
2. Conduct an inventory of the spring complex to identify all species of mollusks, plants and aquatic organisms, especially native species of special concern.
3. Work with the Army Corps of Engineers to obtain necessary permit to work in wetland areas to collect water at the spring complex and rebuild the water supply system and rearing units.
4. Work to provide funding for a complete hatchery rebuild; or at a minimum, collection of the spring complex. The feasibility study conducted by FishPro in 1996 estimated collection of the

spring complex and rebuild of the hatchery building and raceways at $3.7 million; in 2008 dollars the project is estimated at $6,500,000. The cost of only collecting the spring in 1996 was estimated at $192,000; in 2008 dollars the project could cost above $450,000.

5. Develop a plan to accommodate native species found in the spring complex.
6. Ensure that the amount of water returned to Spring Creek will full fill the irrigation water right of down stream water users.
7. Ensure that the construction phase for water collection addresses: daily decontamination of site, decontamination of equipment and by-pass of surface water to retain wetland values.
8. Ensure that new facilities are secure enough to prevent contamination by ground water, mammals, birds and humans (water tight water transmission lines, covered raceways, barriers to prevent upstream movement of mollusks).
9. Maintain a disinfection station with a hot water pressure washer and containment drainage system.
10. Do not allow visitors inside of the production facilities.
11. Follow the "Hatchery Sampling and Cleaning Protocols" (Appendix B) to ensure quarterly NZMS sampling and equipment methods are consistent and approved.
12. Maintain an up-to-date HACCP plan (Appendix C) and ensure that all steps are followed.

The Fisheries Experiment Station at Logan will continue to research methods to control or kill New Zealand Mudsnails, refine protocols to prevent movement between waters and purging snails from infested fish prior to stocking.

This plan was taken to the Wildlife Board on April, 10, 2008 for their review and comment.

APPROVED BY:_____

Walter Donaldson, Aquatics Program Chief Date